PATENT ABSTRACTS OF JAPAN

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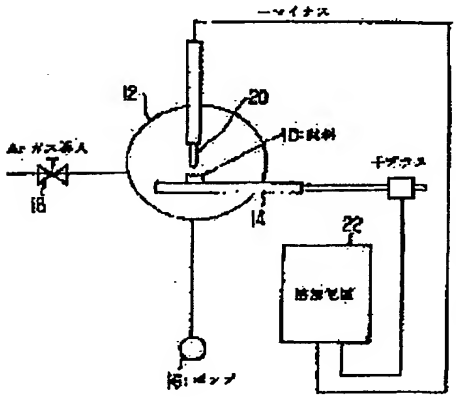
(71)Applicant : **TOYOTA MOTOR CORP**
(72)Inventor : **SAKAMOTO HIDEMITSU**
SATO KAZUAKI

(54) PRODUCTION OF CARBON NANOTUBE



(57)Abstract:
PROBLEM TO BE SOLVED: To provide a producing method of a carbon nanotube by which high uniformity in the diameter and length of obtd. carbon nanotubes can be obtd. and the synthesis can be easily controlled.
SOLUTION: A sample 10 comprising a compacted SiC powder or a compacted mixture of a SiC powder and a carbon powder is mounted on a sample holder 14 and housed in an arc fusing furnace 12, which is evacuated by a pump 16. Argon is introduced through an argon gas inlet valve 18 to the arc fusing furnace 12 to replace the inner atmosphere with the argon gas. Then, a voltage is applied to the sample holder 14 and an electrode 20 from a fusing power supply 22 to produce arc discharge to irradiate the sample 10 with the arc. Thereby, the sample 10 is heated to ≥2000°C and carbon nanotubes having rather uniform diameters can be produced on the sample surface.

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to improvement of the manufacture method of a carbon nanotube.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, generation control of a carbon nanotube is easily attained by the current value of arc discharge.
[0019] Moreover, by adding carbon powder to SiC, conductivity becomes high and becomes generable [a carbon nanotube] by the low current more.

PRIOR ART

[Description of the Prior Art] The structures in which the carbon hex-steel side closed the carbon nanotube in the shape of a cylinder, or these cylinders are carrying out multilayer structure arranged in the shape of a nest. The path is very a narrow thing with several nm - dozens of nm. As for this carbon nanotube, application will be expected as electronic material, an adsorption material of gas, etc. from now on. In order to use it for these uses widely, it is necessary to raise the stacking tendency of a carbon nanotube or to raise the path of a tube, and the homogeneity of length.
[0003] As the manufacture method of such a carbon nanotube, arc discharge is generated between carbon electrodes and the method of growing up a carbon nanotube into the cathode surface of the carbon electrode for electric discharge, the method of irradiating SiC and making a laser beam heat and sublimate to it, etc. are learned.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
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[0002]
[Description of the Prior Art] The structures in which the carbon hex-steel side closed the carbon nanotube in the shape of a cylinder, or these cylinders are carrying out multilayer structure arranged in the shape of a nest. The path is very a narrow thing with several nm - dozens of nm. As for this carbon nanotube, application will be expected as electronic material, an adsorption material of gas, etc. from now on. In order to use it for these uses widely, it is necessary to raise the stacking tendency of a carbon nanotube or to raise the path of a tube, and the homogeneity of length.
[0003] As the manufacture method of such a carbon nanotube, arc discharge is generated between carbon electrodes and the method of growing up a carbon nanotube into the cathode surface of the carbon electrode for electric discharge, the method of irradiating SiC and making a laser beam heat and sublimate to it, etc. are learned.
[0004]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned

conventional manufacture method, there was a problem that it was difficult to obtain alternatively the carbon nanotube which has a uniform path and uniform length, for example by the method by the arc discharge of a carbon electrode.
[0005] Moreover, by the method by SiC sublimation, although the carbon nanotube film of high orientation was generable, the control at the time of composition was difficult, and there was a problem of being unsuitable for mass production method.
[0006] this invention is made in view of the above-mentioned conventional technical problem, the purpose has high path of a carbon nanotube and homogeneity of length which are acquired, and they are to offer the manufacture method of a carbon nanotube with easy composite control.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention is the manufacture method of a carbon nanotube, and is characterized by irradiating arc discharge at the sample which consists of SiC.
[0008] Moreover, it is the manufacture method of a carbon nanotube and is characterized by irradiating arc discharge at the sample which consists of SiC and carbon.
[0009]
[Embodiments of the Invention] Hereafter, the gestalt (henceforth an operation gestalt) of operation of this invention is explained according to a drawing.
[0010] The example of composition of the equipment for enforcing the manufacture method of the carbon nanotube concerning this invention is shown in drawing 1 . In drawing 1 , a sample 10 is set on the sample base 14 in the arc fusion furnace 12. As this sample 10, a SiC Plastic solid or the Plastic solid of the mixture of SiC and carbon powder is used.
[0011] After a sample 10 is set to the sample base 14, vacuum length of the arc fusion furnace 12 is carried out with a pump 16. This initial degree of vacuum has the desirable range of 10-2torr - 10-4torr (1.33Pa - 1.33x10 to 2 Pa). In the case of the degree of vacuum of 10-3torr (1.33x10 to 1 Pa), synthetic efficiency of a carbon nanotube was able to be most made high among this range. Although composition of a carbon nanotube was possible when it considered as the degree of vacuum beyond this, the decline in recovery arose. On the contrary, when a degree of vacuum was made low, the result that the decline in recovery or composition was impossible was brought.
[0012] As mentioned above, after carrying out vacuum length of the arc fusion furnace 12, argon gas is introduced from the argon introduction valve 18, and argon gas replaces the inside of the arc fusion furnace 12. Then, voltage is impressed between the sample base 14 and an electrode 20, arc discharge is generated, and a sample 10 is irradiated. A sample 10 is heated at 2000 degrees C or more by this arc discharge. In addition, the power supply for generating arc discharge is supplied from the dissolution power supply 22. If a sample 10 is heated at 2000 degrees C or more by irradiation of arc discharge, while SiC will be pyrolyzed and Si will be separated, a carbon layer is formed on the surface of SiC. It turns out that the carbon nanotube which has a comparatively uniform path on the front face of the carbon layer is compounded.
[0013] The carbon nanotube has been compounded, when the current impressed from the dissolution power supply 22 was set as the range of 200-800A, in order to generate the above-mentioned arc discharge. Thus, it was found out that the path of the compounded carbon nanotube changes with the current value for arc discharge. The path became large,

so that current value of the path was as small as the low and current value was high. When it was set especially as 400A among the ranges of the above-mentioned current value, the homogeneity of the path of a carbon nanotube was able to be raised most. Thus, since the path of the carbon nanotube compounded by changing the current value for making arc discharge generate was controllable, it became possible to perform generation control of a carbon nanotube easily.

[0014] although a SiC simple substance is sufficient as a sample 10 used for this operation gestalt -- this -- carbon powder -- 5 - 30vol% -- adding is also suitable Thereby, since arc discharge becomes easy, compounding [of a carbon nanotube] becomes more possible also for the low discharge current. In addition, the particle diameter of the SiC powder used for a sample 10 is not limited especially until it results [from a particle] in a big and rough particle. Moreover, especially the purity of SiC is not limited, either.

[0015] The enlarged view of the electric discharge portion in the case of irradiating arc discharge to a sample 10 is shown in drawing 2 . In drawing 2 , it was suitable for the distance x of the sample 10 and electrode 20 in the case of carrying out arc discharge to be referred to as 15-20mm.

[0016] The SEM photograph of the carbon nanotube generated by the above manufacture methods by the system which added carbon powder to SiC is shown in drawing 3 . Moreover, the SEM photograph of the carbon nanotube generated on SiC powder is shown in drawing 4 , and the transverse-electromagnetic photograph is shown in drawing 5 .

[0017] Since a carbon nanotube can be compounded in large quantities and easily when based on the manufacture method of the carbon nanotube concerning the above this inventions, a manufacturing cost can be reduced by leaps and bounds.

[0018]

[Effect of the Invention] As explained above, according to this invention, generation control of a carbon nanotube is easily attained by the current value of arc discharge.

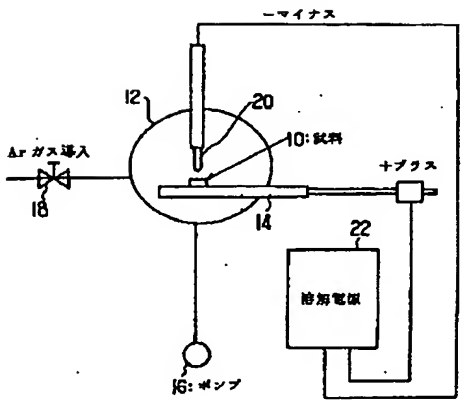
[0019] Moreover, by adding carbon powder to SiC, conductivity becomes high and becomes generable [a carbon nanotube] by the low current more.

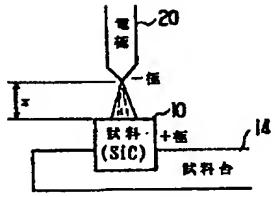
CLAIMS

[Claim(s)]

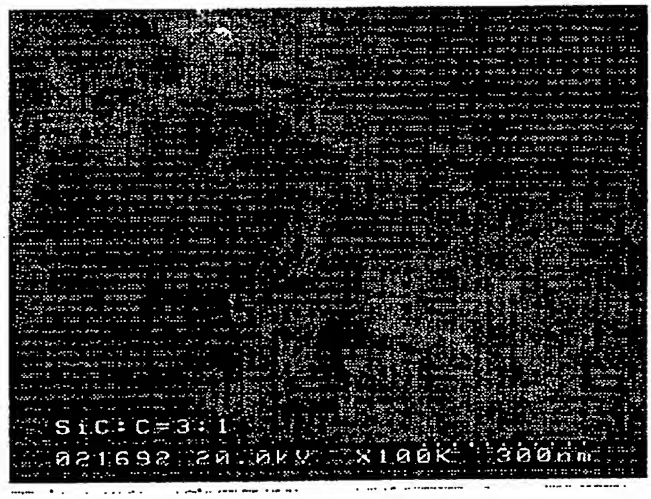
[Claim 1] The manufacture method of the carbon nanotube characterized by irradiating arc discharge at the sample which consists of SiC.

[Claim 2] The manufacture method of the carbon nanotube characterized by irradiating arc discharge at the sample which consists of SiC and carbon.


−マイナス
12
20
10:試料
Arガス導入
十プラス
18
14
22
16:ポンプ


20
−極
x
10
試料
(SiC)
+極
14
試料台

図面代用写真


SiC:C=3:1
021692 20.0kV X100K 300nm

図面代用写真

図面代用写真